Human Computer Interaction

Week 5

CHAPTER 3:
Managing Design Processes

Designing the User Interface:
Strategies for Effective Human-Computer Interaction

Fifth Edition

Ben Shneiderman & Catherine Plaisant

in collaboration with

Maxine S. Cohen and Steven M. Jacobs

Addison Wesley
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PEARSON

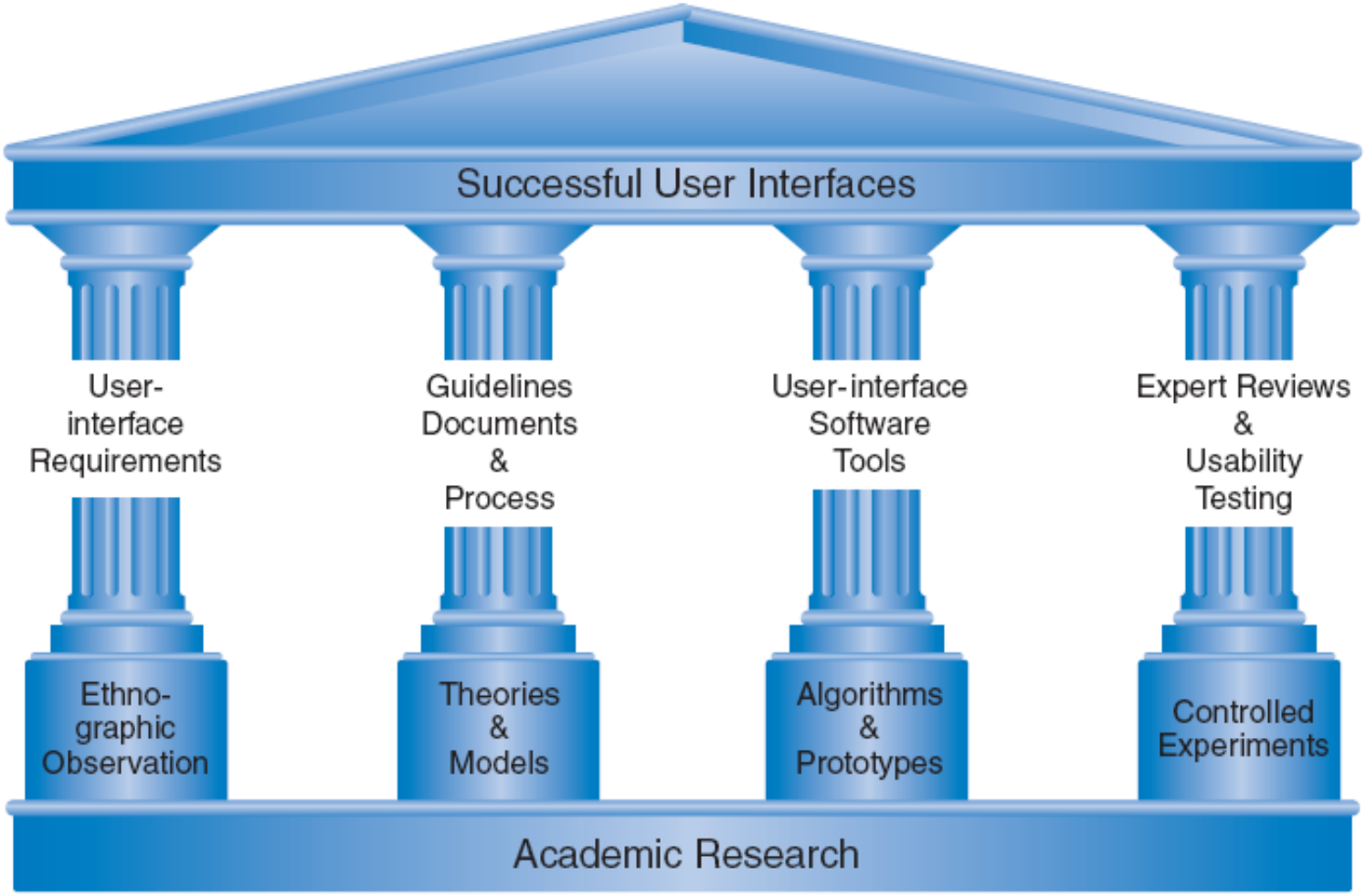
Organizational Design and Support Usability

- Design is inherently creative and unpredictable. Interactive system designers must blend knowledge of technical feasibility with a mystical esthetic sense of what attracts users. hared language
- Carroll and Rosson design characterization:
  - Design is a process, not a state.
  - The design process is *nonhierarchical*.
  - The process is *radically transformational*.
  - Design intrinsically involves the *discovery of new goals.*

Organizational Design and Support Usability (cont.)

- “Usability engineering” has evolved into a recognized discipline with maturing practices and a growing set of standards
- Usability engineers and user-interface architects, sometimes called the user experience (UX) team are gaining experience in organizational change
- There are numerous papers and reporting addressing return on investment (ROI) for usability testing
- The Usability Professional's Association (UPA) holds annual meetings called the “World Usability Day”

The Four Pillars of Design



The Four Pillars of Design

- **User Interface Requirements**
  - Soliciting and clearly specifying user requirements is a major key to success in any development activity
  - Laying out the user-interface requirements is part of the overall requirements development and management process
  - User interface requirements describe system behavior
- **Ethnographic Observation**
  - Identifying and observing the user community in action
  - Discussed later

The Four Pillars of Design

- **Guidelines documents and processes**

  Each project has different needs, but guidelines should be considered for:

- **Words, icons, and graphics**
  - Terminology (objects and actions), abbreviations, and capitalization
  - Character set, fonts, font sizes, and styles (bold, italic, underline)
  - Icons, graphics, line thickness, and
  - Use of color, backgrounds, highlighting, and blinking

The Four Pillars of Design (cont.)

- **Screen-layout issues**
  - Menu selection, form fill-in, and dialog-box formats
  - Wording of prompts, feedback, and error messages
  - Justification, white space, and margins
  - Data entry and display formats for items and lists
  - Use and contents of headers and footers
- **Input and output devices**
  - Keyboard, display, cursor control, and pointing devices
  - Audible sounds, voice feedback, touch input, and other special devices
  - Response time for a variety of tasks

The Four Pillars of Design (cont.)

- **Action sequences**
  - Direct-manipulation clicking, dragging, dropping, and gestures
  - Command syntax, semantics, and sequences
  - Programmed function keys
  - Error handling and recovery procedures
- **Training**
  - Online help and tutorials
  - Training and reference materials
  - Command syntax, semantics, and sequences

The Four Pillars of Design (cont.)

- Provides a social process for developers
- Records decisions for all parties to see
- Promotes consistency and completeness
- Facilitates automation of design
- Allows multiple levels:
  - Rigid standards
  - Accepted practices
  - Flexible guidelines
- Announces policies for:
  - Education: How to get it?
  - Enforcement: Who reviews?
  - Exemption: Who decides?
  - Enhancement: How often?

uidelines creation should be a social process within an organizat
to help it gain visibility and build support

Developmental Methodologies

Role/Phase Matrix	All Phases	Business Opportunity	Understanding Users	Initial Design	Development	Deployment	Life Cycle
All Roles							
User Experience Leadership		User Engineering Plan-Initial	User Engineering Plan-Final	Execution of the User Engineering Plan	Satisfaction of Established Metrics	Project Assessment	Satisfaction Survey
Market Planning		Business and Market Requirements	Appropriate User Requirements	Draft Marketing Collateral	Detail Marketing Collateral	Final Marketing Collateral	
User Research			User Requirements	Appropriate Design			
User Experience Design			Design Direction	Conceptual Design, Low-Fidelity Prototypes	Detail Design, High-Fidelity Prototypes	Design Issue Resolution	
Visual & Industrial Design			Appearance Direction	Appearance Guidelines	Appearance Specification		
User Experience Evaluation			Competitive Evaluation	Conceptual Design Evaluation	Detail Design Evaluations	User Feedback and Benchmark	Usage Issue Report

IBM's Ease of Use development methodology specifies activities by roles and phases

Rapid Contextual Design

Contextual inquiry
Interpretation sessions and work modeling
Model consolidation and affinity diagram building
Personas
Visioning
Storyboarding
User environment design
Paper prototypes and mock-up interviews

From Holtzblatt, et al., *Rapid Contextual Design: A How-To Guide to Key Techniques for User-Centered Design*

Ethnographic Observation

- **Preparation**
  - Understand organization policies and work culture.
  - Familiarize yourself with the system and its history.
  - Set initial goals and prepare questions.
  - Gain access and permission to observe/interview.

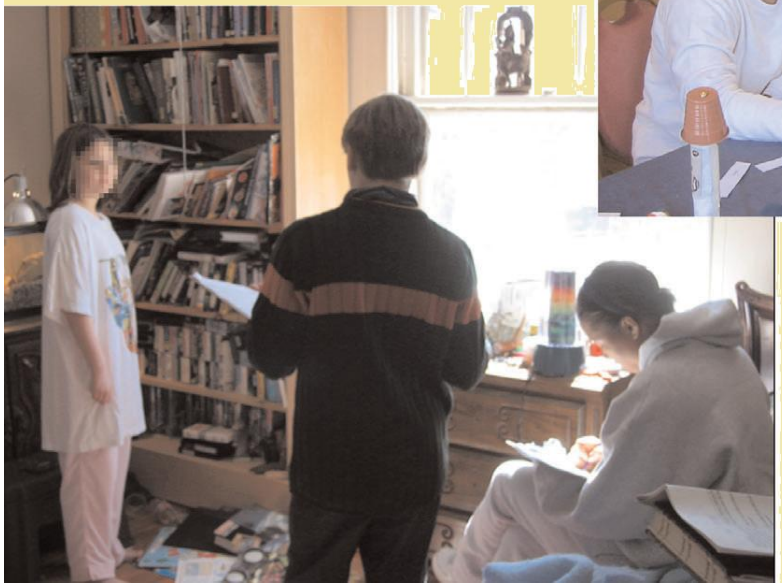
- **Field Study**
  - Establish rapport with managers and users.
  - Observe/interview users in their workplace and collect subjective/objective quantitative/qualitative data.
  - Follow any leads that emerge from the visits.

Ethnographic Observation (cont.)

- **Analysis**
  - Compile the collected data in numerical, textual, and multimedia databases.
  - Quantify data and compile statistics.
  - Reduce and interpret the data.
  - Refine the goals and the process used.

- **Reporting**
  - Consider multiple audiences and goals.
  - Prepare a report and present the findings**.**

Participatory Design



Participatory Design (cont.)

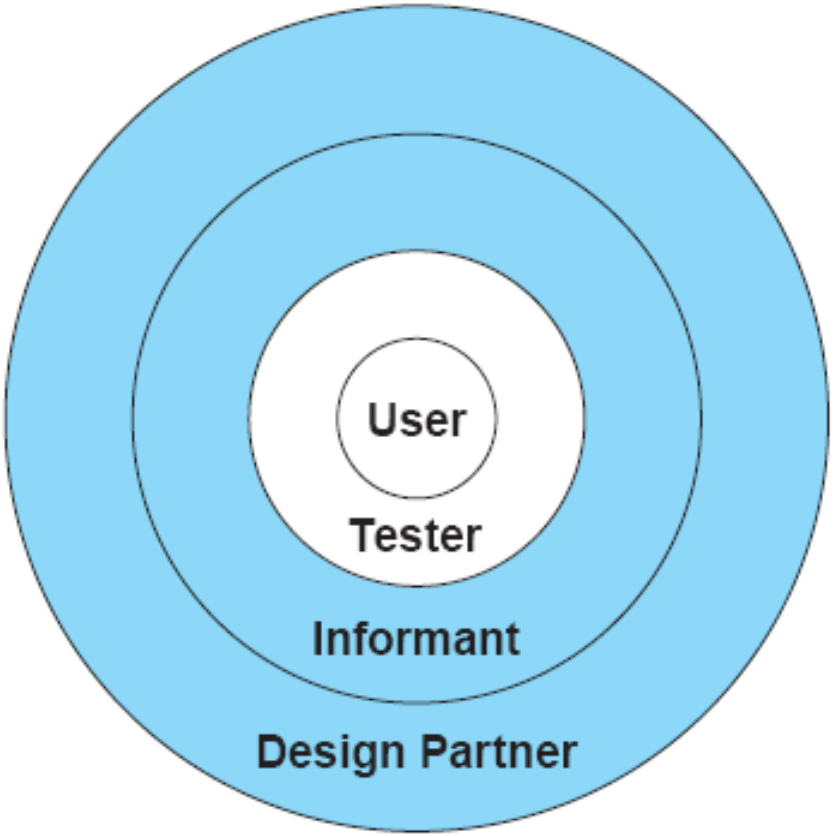
Controversial

- More user involvement brings:
  - more accurate information about tasks
  - more opportunity for users to influence design decisions
  - a sense of participation that builds users' ego investment in successful implementation
  - potential for increased user acceptance of final system

Participatory Design (cont.)

- On the negative side, extensive user involvement may:
  - be more costly
  - lengthen the implementation period
  - build antagonism with people not involved or whose suggestions rejected
  - force designers to compromise their design to satisfy incompetent participants
  - build opposition to implementation
  - exacerbate personality conflicts between design-team members and users
  - show that organizational politics and preferences of certain individuals are more important than technical issues

Participatory Design (cont.)



Scenario Development

Day-in-the-life scenarios:

- characterize what happens when users perform typical tasks
- can be acted out as a form of walkthrough
- may be used as basis for videotape
- useful tools
  - table of user communities across top, tasks listed down the side
  - table of task sequences
  - flowchart or transition diagram

Social Impact Statement for Early Design Review

Describe the new system and its benefits

- Convey the high level goals of the new system.
- Identify the stakeholders.
- Identify specific benefits

Social Impact Statement for Early Design Review (cont.)

Address concerns and potential barriers

- Anticipate changes in job functions and potential layoffs.
- Address security and privacy issues.
- Discuss accountability and responsibility for system misuse and failure.
- Avoid potential biases.
- Weigh individual rights vs. societal benefits.
- Assess trade-offs between centralization and decentralization.
- Preserve democratic principles.
- Ensure diverse access.
- promote simplicity and preserve what works.

Social Impact Statement for Early Design Review (cont.)

Outline the development process

- Present and estimated project schedule.
- Propose process for making decisions.
- Discuss expectations of how stakeholders will be involved.
- Recognize needs for more staff, training, and hardware.
- Propose plan for backups of data and equipment.
- Outline plan for migrating to the new system.

Legal Issues

Potential Controversies

- What material is eligible for copyright?
- Are copyrights or patents more appropriate for user interfaces?
- What constitutes copyright infringement?
- Should user interfaces be copyrighted?
- Evolving public policies related to:
  - Privacy
  - Liability related to system safety/reliability
  - Freedom of speech

CHAPTER 4:
Evaluating interface Designs

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Introduction

- Designers can become so entranced with their creations that they may fail to evaluate them adequately.
- Experienced designers have attained the wisdom and humility to know that extensive testing is a necessity.
- The determinants of the evaluation plan include:
  - stage of design (early, middle, late)
  - novelty of project (well defined vs. exploratory)
  - number of expected users
  - criticality of the interface (life-critical medical system vs. museum exhibit support)
  - costs of product and finances allocated for testing
  - time available
  - experience of the design and evaluation team

Introduction (cont.)

- Usability evaluators must broaden their methods and be open to non-empirical methods, such as user sketches, consideration of design alternatives, and ethnographic studies.
- Recommendations needs to be based on observational findings
- The design team needs to be involved with research on the current system design drawbacks
- Tools and techniques are evolving
- The range of evaluation plans might be anywhere from an ambitious two-year test with multiple phases for a new national air-traffic–control system to a three-day test with six users for a small internal web site
- The range of costs might be from 20% of a project down to 5%.
- Usability testing has become an established and accepted part of the design process

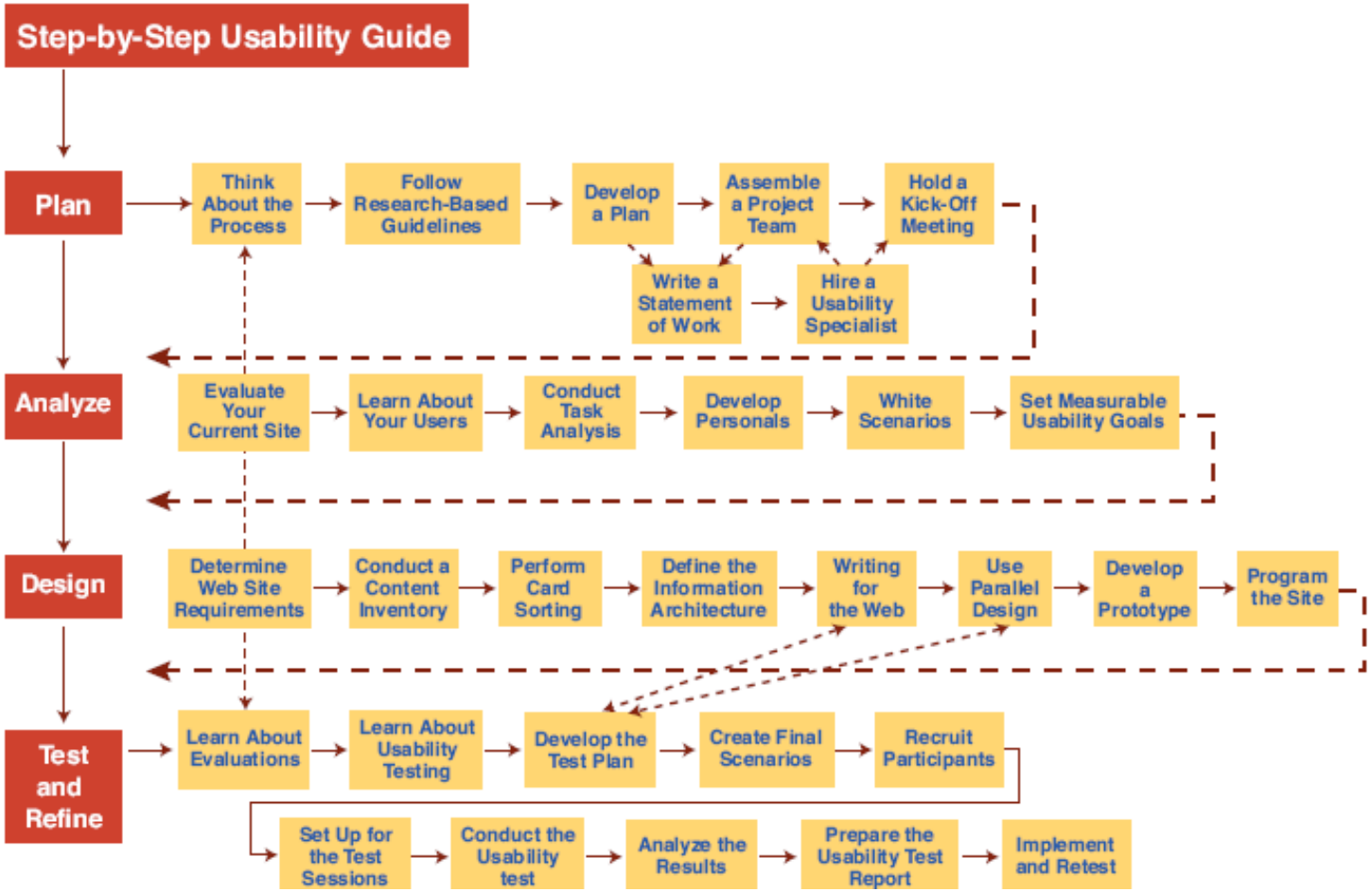
Expert Reviews

- While informal demos to colleagues or customers can provide some useful feedback, more formal expert reviews have proven to be effective
- Expert reviews entail one-half day to one week effort, although a lengthy training period may sometimes be required to explain the task domain or operational procedures
- There are a variety of expert review methods to chose from:
  - Heuristic evaluation
  - Guidelines review
  - Consistency inspection
  - Cognitive walkthrough
  - Metaphors of human thinking
  - Formal usability inspection

Expert Reviews (cont.)

- Expert reviews can be scheduled at several points in the development process when experts are available and when the design team is ready for feedback.
- Different experts tend to find different problems in an interface, so 3-5 expert reviewers can be highly productive, as can complementary usability testing.
- The dangers with expert reviews are that the experts may not have an adequate understanding of the task domain or user communities.
- Even experienced expert reviewers have great difficulty knowing how typical users, especially first-time users will really behave.

Step-by-Step Usability Guide from http://usability.gov/



Usability Testing and Laboratories

Usability Testing and Laboratories (cont.)

- The emergence of usability testing and laboratories since the early 1980s
- Usability testing not only sped up many projects but that it produced dramatic cost savings.
- The movement towards usability testing stimulated the construction of usability laboratories.
- A typical modest usability lab would have two 10 by 10 foot areas, one for the participants to do their work and another, separated by a half-silvered mirror, for the testers and observers
- Participants should be chosen to represent the intended user communities, with attention to
  - background in computing, experience with the task, motivation, education, and ability with the natural language used in the interface.

Usability Testing and Laboratories (cont.)

- Participation should always be voluntary, and informed consent should be obtained.
- Professional practice is to ask all subjects to read and sign a statement like this one:
  - I have freely volunteered to participate in this experiment.
  - I have been informed in advance what my task(s) will be and what procedures will be followed.
  - I have been given the opportunity to ask questions, and have had my questions answered to my satisfaction.
  - I am aware that I have the right to withdraw consent and to discontinue participation at any time, without prejudice to my future treatment.
  - My signature below may be taken as affirmation of all the above statements; it was given prior to my participation in this study.
- Institutional Review Boards (IRB) often governs human subject test process

Usability Testing and Laboratories (cont.)

- Videotaping participants performing tasks is often valuable for later review and for showing designers or managers the problems that users encounter.
  - Use caution in order to not interfere with participants
  - Invite users to think aloud (sometimes referred to as concurrent think aloud) about what they are doing as they are performing the task.

- Many variant forms of usability testing have been tried:
  - Paper mockups
  - Discount usability testing
  - Competitive usability testing
  - Universal usability testing
  - Field test and portable labs
  - Remote usability testing
  - Can-you-break-this tests

Usability Testing and Laboratories (cont.)

In this eye-tracking setup, the participant wears a helmet that monitors and records where on the screen the participant is looking

Usability Testing and Laboratories (cont.)

More portable eye-tracking devices

Survey Instruments

- Written user surveys are a familiar, inexpensive and generally acceptable companion for usability tests and expert reviews.

- Keys to successful surveys
  - Clear goals in advance
  - Development of focused items that help attain the goals.

- Survey goals can be tied to the components of the Objects and Action Interface model of interface design.

- Users could be asked for their subjective impressions about specific aspects of the interface such as the representation of:
  - task domain objects and actions
  - syntax of inputs and design of displays.

Survey Instruments (cont.)

- Other goals would be to ascertain
  - users background (age, gender, origins, education, income)
  - experience with computers (specific applications or software packages, length of time, depth of knowledge)
  - job responsibilities (decision-making influence, managerial roles, motivation)
  - personality style (introvert vs. extrovert, risk taking vs. risk aversive, early vs. late adopter, systematic vs. opportunistic)
  - reasons for not using an interface (inadequate services, too complex, too slow)
  - familiarity with features (printing, macros, shortcuts, tutorials)
  - their feeling state after using an interface (confused vs. clear, frustrated vs. in-control, bored vs. excited).

Surveys (cont.)

- Online surveys avoid the cost of printing and the extra effort needed for distribution and collection of paper forms.
- Many people prefer to answer a brief survey displayed on a screen, instead of filling in and returning a printed form,
  - although there is a potential bias in the sample.
- A survey example is the Questionnaire for User Interaction Satisfaction (QUIS).
  - http://lap.umd.edu/quis/

Acceptance Test

- For large implementation projects, the customer or manager usually sets objective and measurable goals for hardware and software performance.
- If the completed product fails to meet these acceptance criteria, the system must be reworked until success is demonstrated.
- Rather than the vague and misleading criterion of "user friendly," measurable criteria for the user interface can be established for the following:
  - Time to learn specific functions
  - Speed of task performance
  - Rate of errors by users
  - Human retention of commands over time
  - Subjective user satisfaction

Acceptance Test (cont.)

- In a large system, there may be eight or 10 such tests to carry out on different components of the interface and with different user communities.

- Once acceptance testing has been successful, there may be a period of field testing before national or international distribution..

Evaluation During Active Use

- Successful active use requires constant attention from dedicated managers, user-services personnel, and maintenance staff.
- Perfection is not attainable, but percentage improvements are possible.
- Interviews and focus group discussions
  - Interviews with individual users can be productive because the interviewer can pursue specific issues of concern.
  - Group discussions are valuable to ascertain the universality of comments.

Evaluation During Active Use (cont.)

- Continuous user-performance data logging
  - The software architecture should make it easy for system managers to collect data about
    - The patterns of system usage
    - Speed of user performance
    - Rate of errors
    - Frequency of request for online assistance
  - A major benefit is guidance to system maintainers in optimizing performance and reducing costs for all participants.

- Online or telephone consultants, e-mail, and online suggestion boxes
  - Many users feel reassured if they know there is a human assistance available
  - On some network systems, the consultants can monitor the user's computer and see the same displays that the user sees

Evaluation During Active Use (cont.)

- Online suggestion box or e-mail trouble reporting
  - Electronic mail to the maintainers or designers.
  - For some users, writing a letter may be seen as requiring too much effort.

- Discussion groups, wiki's and newsgroups
  - Permit postings of open messages and questions
  - Some are independent, e.g. America Online and Yahoo!
  - Topic list
  - Sometimes moderators
  - Social systems
  - Comments and suggestions should be encouraged.

Evaluation During Active Use (cont.)

Bug report using Google's Chrome browser (http://www.google.com/chrome/)

Controlled Psychologically-oriented Experiments

- Scientific and engineering progress is often stimulated by improved techniques for precise measurement.

- Rapid progress in the designs of interfaces will be stimulated as researchers and practitioners evolve suitable human-performance measures and techniques.

Controlled Psychologically-oriented Experiments (cont.)

- The outline of the scientific method as applied to human-computer interaction might comprise these tasks:
  - Deal with a practical problem and consider the theoretical framework
  - State a lucid and testable hypothesis
  - Identify a small number of independent variables that are to be manipulated
  - Carefully choose the dependent variables that will be measured
  - Judiciously select subjects and carefully or randomly assign subjects to groups
  - Control for biasing factors (non-representative sample of subjects or selection of tasks, inconsistent testing procedures)
  - Apply statistical methods to data analysis
  - Resolve the practical problem, refine the theory, and give advice to future researchers

Controlled Psychologically-oriented Experiments (cont.)

- Controlled experiments can help fine tuning the human-computer interface of actively used systems.
- Performance could be compared with the control group.
- Dependent measures could include performance times, user-subjective satisfaction, error rates, and user retention over time.